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CIVIL ENGINEERING REPORT INCORPORATING WATER CYCLE MANAGEMENT STRATEGY

SSD 9522 (MOD3)

MAMRE ROAD & SOUTHERN LINK RD. KEMPS CREEK NSW

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EXECUTIVE SUMMARY

The Frasers Property Australia & Altis Property Partners Joint Venture (The JV) are seeking to apply for a modification (MOD3) to their SSD-9522 approved development at 657-769 Mamre Road, Kemps Creek Industrial Estate known as "The Yards".

The Proposal is considered State significant development (SSD) and accordingly, an Environmental Impact Statement (EIS) has been prepared to support the SSD-9522 MOD3 Application for the Proposal. This Water and Hydrology Assessment has been prepared by Costin Roe Consulting to support the preparation of the EIS and assess the Proposal's impact on the surrounding environment in relation to soils and water including stormwater and stormwater management for both construction and operational phases of the development. MOD3 changes have been described in **Section 2.2**. Bakers Lane Intersection description and TfNSW comments have been responded to in **Section 4.2 and 4.3** respectively.

Proposal overview

The proposed development is for a modification to the masterplan layout for the area of the development north of Bakers Lane (Lots 1-4) and introduction of a new local industrial cul-de-sac road. Site works will include bulk earthworks, provision of services, and stormwater drainage and has completed in accordance with the Development Masterplan.

Purpose of this assessment

This Water and Hydrology Impact Assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) as they related to water and hydrology, including:

- Stormwater Management including stormwater quantity and quality during operation;
- Flooding; and
- Stormwater Management, including Erosion & Sediment Control during construction.

Construction impacts

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

Operational impacts

During the operational phase of the development, the site discharges to the SSD-9522 and SSD-9522 MOD1 approved estate stormwater management system which incorporates the use of a treatment train of GPT's and bio-retention filtration is proposed to mitigate any increase in stormwater pollutant load generated by the development and reduction of post development discharge to pre-developed discharge. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

The stormwater management solution considers discharge from the development site consistent with the Estate Stormwater Management Strategy and best practice.

Further it has been confirmed that the development meets flood planning requirements and does not impact or encroach on existing flood affected areas (as defined in separate approval to COUNCIL and associated TUFLOW flooding assessment completed by Costin Roe Consulting). This shows that local post development flows from the site, in conjunction with the flood management measures to be adopted in the flooding assessment demonstrates that the site discharge will not adversely affect any land, drainage system or watercourse as a result of the development.

Conclusion

The hydrological assessment of the local site drainage confirms that recommended water quality and quantity measures will ensure that no adverse impacts result on receiving waterways as a result of the development.

The detail contained in this report provides sufficient information to show the consent authority that legal points of discharge and a suitable stormwater management strategy is available for the development and the requirements associated with the strategy. It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

We conclude that the impacts and assessments associated with the MOD3 application are consistent with those already assessed and approved as part of SSD-9522 and SSD-9522 MOD1.

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1 INTRODUCTION & SCOPE

1.1 Introduction

Costin Roe Consulting Pty Ltd has been commissioned by Frasers Property Australia & Altis Property Partners JV to undertake a *Civil Engineering Report & Water Cycle Management Strategy* (WCMS) to accompany a Modification (Mod3) to the approved State Significant Development Application (SSDA-9522) with the NSW Department of Planning, Industry and Environment (DPIE) for the future industrial development of the land. This report presents a civil engineering assessment of a property bounded by WaterNSW Supply Pipes, Lot 23 DP258414, South Creek and Mamre Road, Erskine Park. The development will be referred to The Yards Estate (The Yards) in this report.

This report provides an assessment of the civil engineering characteristics of the development site and technical considerations of the following aspects:

- Earthworks & geotechnical considerations;
- Roads and Access;
- Water Cycle Management Strategy (WCMS).

The WCMS comprises several key areas of stormwater and water management which are provided below. These key areas have been established with the aim to reduce impacts from the MSE development on the surrounding environment and neighbouring properties including the adjacent South Creek and South Creek corridor. The water cycle management strategy identifies the management measures required to meet the targets set. The key water cycle management areas assessed in this report, consistent with the approved SSD-9522 strategy, are:

- Storm Water Quantity;
- Storm Water Quality;
- Water Supply and Reuse;
- Flooding; and
- Erosion and Sediment Control

This engineering analysis is based on development for industrial warehouse and logistic facilities consistent with industrial estates in the surrounding areas and indicative Masterplan provided by Frasers Property and Altis.

1.2 SSD-9522 Application History and MOD3 Discussion

The original SSD-9522 was approved by the DPIE on 24 December 2020. SSD-9522 Mod1, which entailed lot configuration amendments to Lot 5 to 8, was also recently approved (3 September 2021) by the DPIE, with the support of a similar water and soil assessment by Costin Roe Consulting.

We further note that a further modification applications, SSD-9522 Mod2, which proposes amended road hierarchy and as such road cross sections (based on detailed

Traffic Impact Assessments and consultation with DPIE and Council), has been submitted and is currently under consideration by DPIE at the time of preparation of this report. The amendments as approved and those proposed in the modification under consideration have been included in this assessment.

Under this SSD-9522 MOD, the key differences for the Mod3 application relates to a masterplan change to suit a user (refer layout in **Figure 2.2**) and to improve access to lots north of Bakers Lane and the Southern Link Road corridor. No changes are proposed to any developments or layouts are proposed south of Bakers Lane and the Southern Link Road corridor. The overall civil engineering strategy, including stormwater management, erosion and sediment controls and flood impacts remain consistent with the approved strategy. The updated report and drawings confirm the changes to earthworks and drainage layout to suit the new masterplan layout including the revised lot layout and introduction of an access cul-de-sac north of Bakers Lane and the Southern Link Road corridor.

We further note that the Mod1 application does not propose any changes to the filling extent or filling levels within the zone of influence of the flood plain. As such, no revised flood modelling or updates to the approved flood modelling are required for the Mod1 application. All modelling results and outcomes of the approved development remain consistent with the Mod1 application.

Finally, we note that construction activities approved under the original SSD-9522 and SSD-9522 MOD1 assessments are currently being constructed, including earthworks, drainage and detention and water quality systems.

1.3 SEAR's Response Items

This section of the report covers items relating to the NSW Department of Planning and Environment SEAR's. As there have been no new SEAR's provided for the current modification submission, the items included in the original SSD-9522 SEAR's (dated 14 September 2018) have been commented on.

Further reference to the EIS prepared by Willowtree Planning should be made for confirmation of how the SEAR's have been addressed for non-civil engineering or WCM related items.

SEARS - Flooding *A detailed hydrological and hydraulic assessment which includes the following:*	
Item 1.1	*A comprehensive assessment of the impact of flooding on the development for the full range of flood events to the probable maximum flood. This assessment should address the relevant provisions of the NSW Floodplain Development Manual (2005) including the potential effects of climate change, sea level rise and an increase in rainfall intensity.* Response A comprehensive flood assessment which includes potential effects of climate change, sea level rise and increased rainfall runoff was assessed and approved in the original SSD-9522 approval. Refer separate approved report by Costin Roe Consulting, **Co13362.00-19.rpt.** The MOD3 masterplan layout does not result in a change to any of the outcomes or findings of the approved assessments. The assessment includes a 10% increase in rainfall intensity. This increase is considered representative of potential climate change impacts for the Sydney metropolitan area (being consistent with projected rainfall increases in accordance with the New South Wales Department of Environment and Climate Change (DECC) 'Floodplain Risk Management Guideline Practical Consideration of Climate Change' (Table 1, October 2007).
Item 1.2	*Consideration of current flood behavior and impacts, including on the flood detention areas, how flood behavior and impacts will change due to the proposal and how these changes will be mitigated.* Response Refer separate SSD-9522 approved report by Costin Roe Consulting, **Co13362.00-19.rpt**, for comprehensive flood assessment which includes the above items.
Item 1.3	*Assessments of the impact of the development on flood behavior (i.e. levels, velocities and duration of flooding) and on adjacent, downstream and upstream areas.* Response Refer separate SSD-9522 approved report by Costin Roe Consulting, **Co13362.00-19.rpt**, for comprehensive flood assessment which includes the above items.
Item 1.4	*Detail proposed floor levels for all proposed habitable structures on the site having considered the full range of flood events up to the probable maximum flood.*

	Response Flood planning level of the site has been based on normal, social and industry accepted freeboard allowances for industrial development. A minimum level of 1% AEP plus 0.5m freeboard has been adopted. The adopted flood planning level is consistent with nearby industrial estates and council adopted policy. It is further noted that proposed development levels are higher than the PMF flood event. The MOD3 masterplan layout does not result in a change to any of the outcomes or findings of the approved assessments.
Item 1.5	*Detail an emergency flood response plan for the site which includes consideration of a flood-free access to or from the development site in extreme flood events.* Response Refer separate approved report by Costin Roe Consulting, **Co13362.00-19.rpt**, for comprehensive flood assessment which includes flood response. It is noted that the site is clear of the post-development PMF event and on-site refuge is available. The MOD3 masterplan layout does not result in a change to any of the outcomes or findings of the approved assessments.

SEARS - Soil and Water	
Item 2.1	*A description of how the proposal takes into consideration the South Creek Corridor Strategy and the land use vision for the South Creek Precinct in consultation with Infrastructure NSW and the Greater Sydney Commission.* Response Refer to EIS by Willowtree Planning for comprehensive discussion in relation to the South Creek Corridor Strategy and land vision for the South Creek Precinct.
Item 2.2	*Measures to protect the Warragamba Pipelines corridor from any works or activities associated with the development.* Response All works are proposed to be clear of the Warragamba Pipeline corridor noting a 60m allowance for a potential future rail corridor has been made between the pipeline corridor and the development. Perimeter fencing, and sediment controls are noted to be specified along the southern boundary of the future rail corridor. future common boundary of

	the development and pipeline corridor during construction. Any proposed level differences in the development will employ safe and stable batters, based on recommended slopes from a geotechnical investigation, or via retaining structure. No retaining is currently proposed for the development however future walls may be necessary for individual development sites. These would form part of future designs and development applications. All structures would be within development site and would not affect support or structures within the pipeline corridor. A 60m wide corridor has been included south of the water pipeline as provision for a future freight rail line, with no disturbance in this zone effectively providing a 60m buffer between the development and the water pipeline. It is noted that the built form development is clear of the 1% AEP flood extent hence there will be no post-development change to flood conditions in a 1% AEP flood event. Further that assessment of impacts during the 0.2% AEP have been made and these assessments confirm there are no impacts on the pipeline corridor for this higher order and less frequent storm event. It is expected that there would be limited change to water table as a result of this development, comprising generally filling works. The MOD3 masterplan layout does not result in a change to any of the outcomes or findings of the approved assessments.
Item 2.3	*Details of how access to the Warragamba Pipelines corridor would be maintained, in consultation with Water NSW* <u>Response</u> Access to the pipeline corridor from Mamre Road would be maintained per existing conditions. No change to current access arrangements will occur due to the development. We reiterate there is a 60m buffer between the development area and the Sydney Water Pipeline Corridor for a potential future freight rail line. The MOD3 masterplan layout does not result in a change to any of the outcomes or findings of the approved assessments.
Item 2.4	*A description of water demands and a breakdown of water supplies, including a detailed site water balance.* <u>Response</u> Refer **Section 4**, and subsequent **Sections 5** and **6**, for a comprehensive WCMP which confirms water supplies and reuse requirements. Note the water balance has been performed in respect to the proposed industrial development. A detailed *Service Infrastructure Assessment* has been completed by *Landpartners Built Environment Consultants* and is contained in their report SY073930.000. Reference to this document, included in the

	approved EIS should be made for detailed information pertaining to potable water demands and wastewater management. The MOD3 masterplan layout does not result in a change to any of the outcomes or findings of the approved assessments.
Item 2.5	*Identification of any water licensing requirements under the Water Act 2012 or Water Management Act 2000.* Response We confirm that no water sharing plans or licensing considerations are relevant or proposed as part of the warehouse distribution estate development. Groundwater and/ or surface water will not be sourced as part of water sharing plans.
Item 2.6	*Details of proposed erosion and sediment controls during construction.* Response Refer **Section 9** of this report and associated drawings in **Appendix A** for details of erosion and sediment control during construction.
Item 2.7	*A description of the surface and stormwater management system designed in accordance with Penrith City Councils WSUD Policy, including drainage design, on-site detention, and measures to treat or reuse water.* Response Refer **Section 6** of this report and associated drawings in **Appendix A** for details of stormwater management and WSUD/WCM measures proposed for the operational phase of the development. The MOD3 masterplan layout does not result in a change to any of the outcomes or findings of the approved assessments. The water management measures (including detention basins, GPT's and bio-retention basins) are currently under construction per SSD-9522 and SSD-9522 MOD1 approvals.
Item 2.8	*Characterisation of the nature and extent of any contamination on the site and surrounding area.* Response Refer to contamination assessment.
Item 2.9	*An assessment of potential impacts on surface and groundwater resources, drainage patterns, soil (stability, salinity, and acid sulfate soils (, related infrastructure, watercourse and riparian land and proposed mitigation, management and monitoring measures.*

	Response We confirm that the development does not propose to utilise surface or groundwater water sources. An assessment of the impact on these items is not relevant for the warehouse distribution estate development. Reference to JBS&G Environmental investigation should be made in relation to salinity and acid sulfate soils. The report shows that low potential for these soils will be encountered on site.

2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 Site Description

The Yards Estate is located on the western side of Mamre Road in the suburb of Kemps Creek. The proposal site is located on the central-western portion of The Yards development area, south-west of Bakers Lane, as shown in **Figure 2.1.**

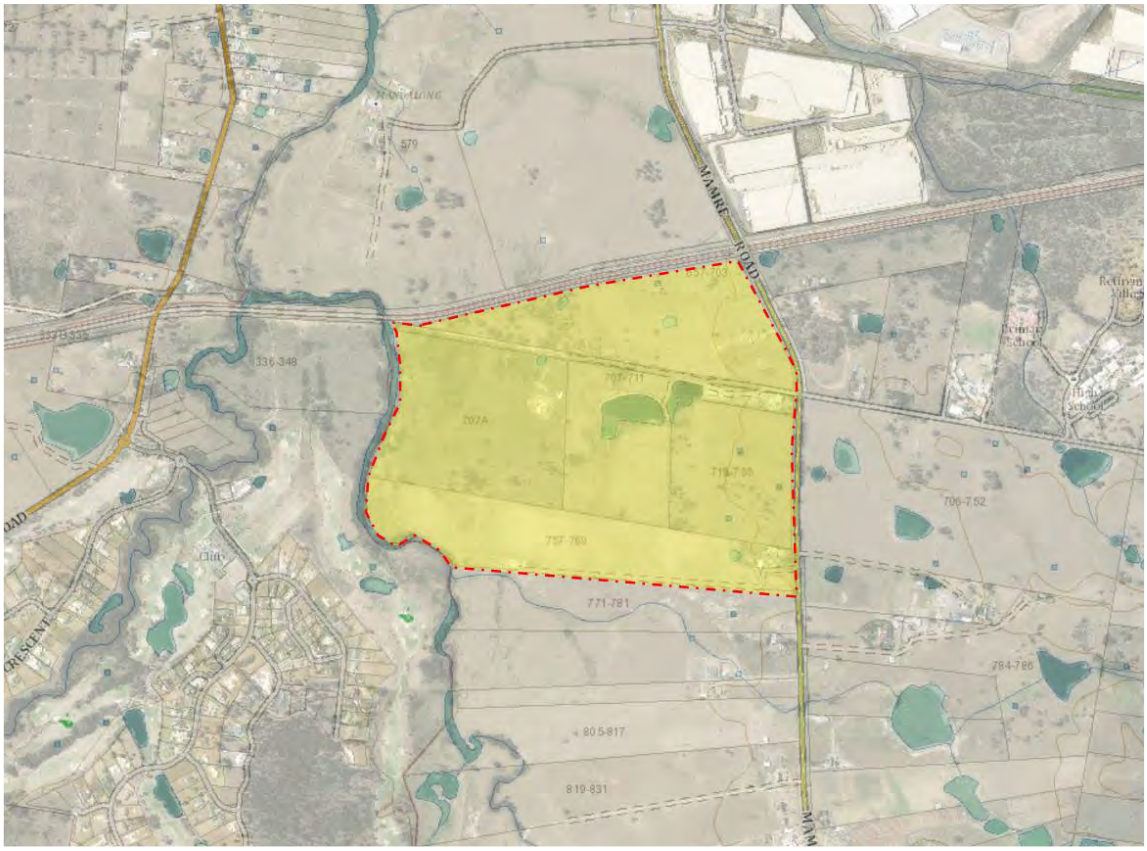

Figure 2.1 Locality Plan

The Yards Estate comprises a combined area of approximately 118 Ha with estate development proposed over approximately 89 Ha of the total land. The pre-existing land-use is predominately rural and rural-residential, noting recent rezoning for industrial use in late 2020.

The highest elevation on The Yards Estate is RL 45m AHD at the intersection of Bakers Lane and Mamre Road. The lowest levels range between RL 30m to RL 34.5m along the western boundary of the site adjacent to South Creek in the South Creek Flood plain.

Grades over the land vary from 0.5% to 2.5% with the grades becoming flatter as you move to the west, away from Mamre Road and toward the South Creek floodplain. South Creek is located on the western boundary of the site.

A major WaterNSW Supply Pipeline is located between on northern property boundary of the study area and the Altis First Estate industrial subdivision is located immediately to the north of the Sydney Water pipe.

Infrastructure works and earthworks are currently being completed as part of the SSD-9522 approvals for the Yards Estate, as described in **Section 2.3** of this report. The SSD-9522 earthworks levels over Lot 10 in which the proposed development will be constructed are between RL 36.5 and RL 38.5m AHD.

2.2 Proposed MOD3 Development Layout

The proposed MOD3 is for a modification to the approved SSDA-9522 layout for Lots 1 to 4 north of Bakers Lane. The proposed lot layout is shown in **Figure 2.2.** Infrastructure works will include bulk earthworks, provision of services, road & intersection construction, and stormwater management and has completed in accordance with the Development Masterplan. As noted, the key change in the MOD3 application relates to the introduction of an additional estate road and cul-de-sac and reconfiguration of lots surrounding the new road.

We note the overall Yards Estate development is for an industrial estate, earthworks and infrastructure for industrial development over an area of approximately 89 Ha, as described in **Section 2.3** and shown in **Figure 2.3**.

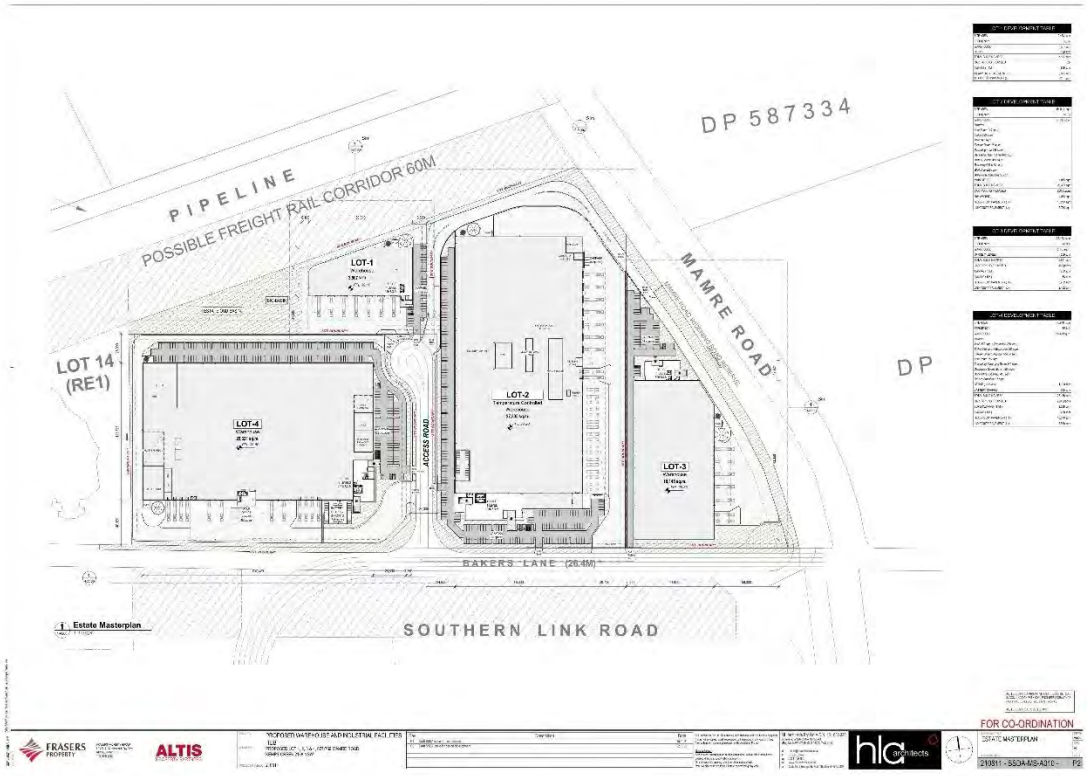

Figure 2.2. Proposed Building Development Masterplan (SSD9522 MOD3)

2.3 The Yards Estate Development

As noted, The Yards Estate was approved for development in December 2020, with subsequent MOD1 approval in September 2021. Bulk earthworks, erosion and sediment control works, and drainage works (including estate stormwater management basins) are currently being completed based on those approvals. Subsequent MOD2 application is currently being considered by DPIE, as described in **Section 1.1** of this report.

The following descriptions of SSD-9522 & associated Mod works are provided for information purposes only as background information for the current MOD3 application:

- Infrastructure works include bulk earthworks, provision of services, road & intersection construction, and stormwater management basins.
- The preliminary masterplan layout provided by Frasers Property shows development lots will vary between 1 Ha and 16 Ha in size. Siting of the development lots will be sympathetic to the topography of the land, access and flood planning requirements.
- All sites in the Estate are sited at levels which include a minimum of 500mm freeboard to the 1% AEP flood level of South Creek.
- Access to all lots are made via the new north-south distributor road (which includes upgraded Bakers Lane) and via a new estate access road from Mamre Road. The new access road and internal intersection will be constructed to Penrith City Council requirements and ownership transferred to Penrith City Council. Intersections with Mamre Road, and upgrades of Mamre Road, are noted to require TfNSW approval.

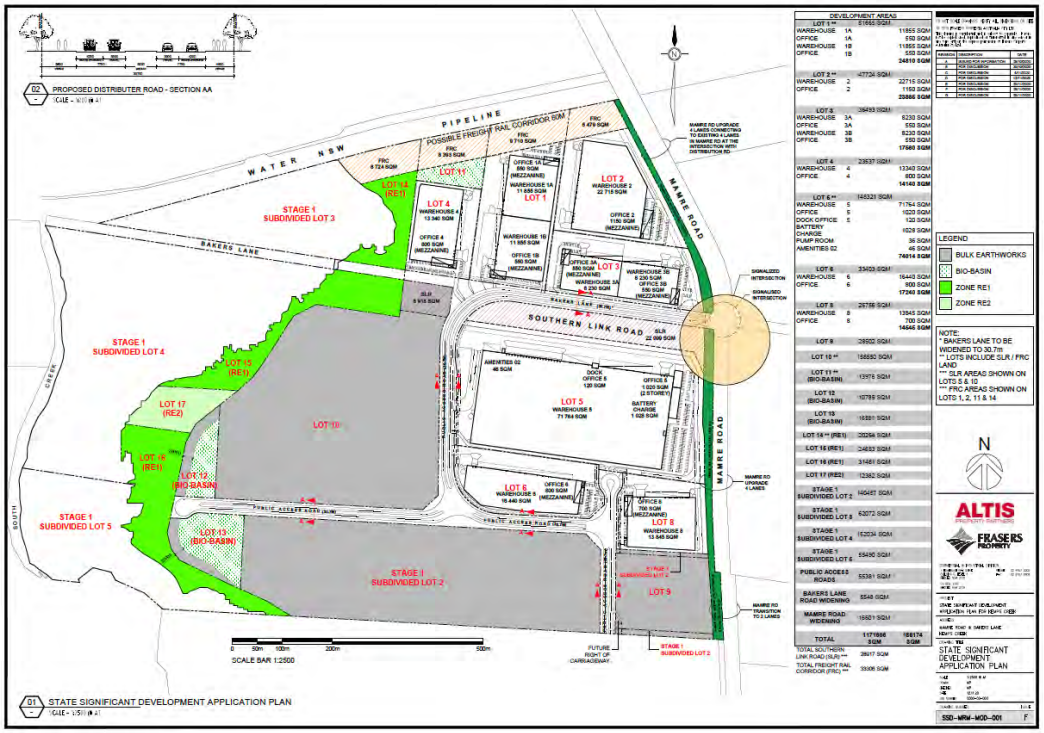

Figure 2.3. SSD-9522 Mod 1 Masterplan Layout

3 EARTHWORKS & FOUNDATIONS

3.1 Soil Profile and Geotechnical Considerations

A geotechnical report has been provided by Pells Sullivan Meynink dated 9 April 2017.

Based on our knowledge of the area, the site is expected to exhibit characteristics consistent with Bringelly Shale Landscapes.

Geotechnical investigations of surrounding sites reference the Penrith 1:100,000 Geological Series Sheet and the areas to the west of Mamre Road are expected to be underlain by Quaternary fluvial sediments and the eastern half by Bringelly Shale of the Wianamatta Group. Alluvial sediments in and around the South Creek flood plain are described as fine-grained sand, silt and clay. The Bringelly Shale is described as shale, claystone, laminate and lithic sandstone.

Engineering properties of the residual clay soils are that they will be moderately reactive, highly plastic subsoils with poor drainage.

The earthworks assessed and approved as part of SSD-9522 and subsequent SSD-9522 MOD1, require filling generally between 2 and 3m in depth. Filling is comprised of clay soils and sandstone placed as engineered fill under Level 1 geotechnical supervision as noted below. These filling works are underway and the current modification requires minor differences to the approved filling and earthworks.

3.2 Earthworks

Extensive earthworks are presently being undertaken under the SSD-9522 & SSD-9522 MOD1 approvals as noted in **Section 2.3** & **3.1**. The earthworks which are currently being constructed, when completed will provide large near flat development pads, though include 1:200 falls over the development sites. These falls are provided to enable runoff and erosion and sediment control during the period between the estate earthworks being completed, and the site specific development lot earthworks.

Modification to the earthworks arrangement are necessary for the MOD3 application to suit the new lot layout, and introduction of the new local road. Earthworks volume estimates and comparison to the previously approved earthwork volume estimates have been provided in **Table 3.1**. Overall the modification design reduces the overall export by approximately 142,000m^3.

Details of earthworks would be finalised during detail design/ construction certificate stages of the development. Detailed assessment of the earthworks level will be completed during detailed design stage and some adjustment to the final pad and building floor levels (within +/-500mm) may be required subject to final geotechnical testing, topsoil assessments and bulking/compaction allowances and slab/ pavement profiles.

The primary drivers for the proposed earthworks are reprofiling of the estate earthworks (which have a general 1:200 fall across the site) to suit the architectural layout and a flat building pad, access from the street, and draining the site via gravity.

The approximate earthworks volume estimates, as shown on **Co13362.00-C4-300** and compared to those approved under SSD-9522 MOD1 are included in **Table 3.1**.

Table 3.1 Earthworks Volumes

Items	Estimated Earthworks Volumes (per SSD9522 MOD1) (m^3)	Proposed Estimated Earthworks Volume (m^3)	Difference (m^3)
Topsoil cut	- 175,000	- 175,000	0
Raw Cut	- 64,300	- 69,200	+ 4,900
Raw Fill	+ 2,110,800	+ 2,084,100	- 26 700
Detailed Excavation (1250m^3/Ha)	- 109,600	- 109,600	0
Difference	+ 1,936,300	+ 1,905,300	-31,000

All geotechnical testing and inspections performed during the earthworks operations will be undertaken to Level 1 geotechnical control, in accordance with AS3798-1996.

Soil erosion and sediment control measures including sedimentation basins will also be provided for the development – please refer to the Draft *Soil and Water Management Plan* in **Appendix C** of this report. These measures will be completed in conjunction with the overall estate sediment control plan, with adjustments made to suit the specific site layout and construction staging on the site.

To assist in maintaining embankment stability, permanent batter slopes will be no steeper than 3 horizontal to 1 vertical while temporary batters will be no steeper than 2 horizontal to 1 vertical. This is in accordance with the recommended maximum batter slopes for residual clays and shale which are present in the area. Permanent batters will also be adequately vegetated or turfed which will assist in maintaining embankment stability.

Stability of batters and reinstatement of vegetation shall be in accordance with the submitted drawings and the DRAFT Soil and Water Management Plan in **Appendix C**.

All geotechnical testing and inspections performed during the earthwork's operations will be undertaken to Level 1 geotechnical control, in accordance with AS3798-1996.

3.3 Groundwater

The geotechnical investigations undertaken by PSM Geotechnical did not encounter groundwater in any of the test locations. It could be expected that groundwater may be experienced at depth or around the normal dry weather water level of South Creek

(which is several meters lower than the pre-earthworks site levels), and that this level would have some seasonal variation and variation associated with periods of high rainfall. In any event, groundwater if present would be at depth below the proposed filled pad levels and interaction with existing groundwater paths would be negligible.

We confirm that the development does not propose to utilise surface or groundwater water sources. An assessment of the impact on these items is not relevant for the warehouse distribution center construction.

Surface water management, including conveyance of surface runoff, management of water quantity (through on-site detention) and water quantity (through on-site and estate wide management systems using WSUD principles and best practice pollution reduction objectives) has been proposed in the design.

In relation to groundwater affectation, this is expected to be negligible. The geotechnical investigations undertaken by PSM did no encounter groundwater in any of the test locations. Further, the majority of the site and site earthworks involve filling, hence any interaction with existing groundwater or groundwater flow paths would negligible and hence not be impacted.

The impacts associated with the MOD3 application are consistent with those already assessed and approved as part of SSD-9522 and SSD-9522MOD1.

3.4 Acid Sulphate Soils

An assessment of the potential for acid sulphate soils has been requested as part of the SEAR's requirements.

Reference to the *NSW Land & Water Conservation Acid Sulphate Soils Map 92_Liverpool* shows the subject land clear of any known occurrence of acid sulphate soils.

An environmental assessment has been undertaken by JBS&G for the development – ref 54963/120704 – as included in the EIS. This report includes assessment of acid sulfate soils (refer Section 2.7 of the JBS&G report).

The JBS&G report showed that the risk of acid sulphate soils were low and this site is not subject to any policies relating to acid sulfate soils. As such no specific requirements relating to management of these soils are considered necessary. Refer to the JBS&G report for more detail on this.

The impacts associated with the MOD3 application are consistent with those already assessed and approved as part of SSD-9522 and SSD-9522MOD1.

3.5 SEPP (WSEA) Clause 33H Earthworks

Consideration to the requirements of SEPP (WSEA) Clause 33H Earthworks has been made in the impact assessment. Review and confirmation specific matters included in Clause 33H(3) has been made for Items (a) through (j) as follows.

a) the likely disruption of, or detrimental effect on, existing drainage patterns and soil stability in the locality,

A detailed flood assessment has been completed in relation to flooding considerations – refer approved report **Co13362.00-19.rpt** by Costin Roe Consulting.

Refer **Sections 6, 7 & 8** of this report and associated drawings in **Appendix A** which set out stormwater management for the site. The proposed strategy incorporates management of site runoff and upstream drainage paths managing quantity and quality and ensuring acceptable impacts in accordance with various council and NSW government policy.

Consideration to stability of soil has been made during and post construction.

b) the effect of the proposed development on the likely future use or redevelopment of the land,

The proposed development (being industrial warehouse distribution development) is consistent with the land zoning. Future redevelopment of similar industrial developments would be able to be undertaken.

c) the quality of the fill or the soil to be excavated, or both,

Geotechnical and environmental assessments have been undertaken for the site and reviews and discusses suitability for use as engineered fill, foundations and other development requirements. The report shows that with due consideration to the design requirements that development would be able to be made over the development footprint.

d) the effect of the proposed development on the existing and likely amenity of adjoining properties,

Adjoining properties to the north, south and east are noted to comprise land zoned for industrial use, hence similar amenity to these frontages is achieved. The areas to the west of the development is zoned RE1 and RE2 and the masterplan has been agreed with the department to include provision for recreational uses as defined in the urban plan for the precinct.

e) the source of fill material and the destination of excavated material,

There is no excavated material to be removed from the site. Import of fill is required and is expected to be sourced from a variety of locations which will need to be confirmed as part of the Construction Management Plan for the development during Construction Certificate stage of the development.

f) the likelihood of disturbing relics,

A heritage and aboriginal impact study has been undertaken. Refer to separate reports.

g) the proximity to and potential for adverse impacts on a waterway, drinking water catchment or environmentally sensitive area,

A detailed flood assessment has been completed in relation to flooding considerations and confirmation of acceptable impacts – refer approved report **Co13362.00-19.rpt** by Costin Roe Consulting. Assessments relating to discharge to water has been made in the Ecologist report (refer separate report). Refer **Section 6, 7 & 8** of this report for confirmation of the approved water quantity, water quality and stream erosion index assessments which confirm acceptable impacts relating to stormwater management.

h) appropriate measures proposed to avoid, minimise or mitigate the impacts of the development,

Appropriate measures during and following development have been made in relation to earthworks, erosion and sediment controls and

i) the proximity to and potential for adverse impacts on a heritage item, an archaeological site, or a heritage conservation area,

A heritage and aboriginal impact study has been undertaken. Refer to separate reports.

j) the visual impact of earthworks as viewed from the waterways.

Refer separate visual impact report in relation to visual.

4 ESTATE ROADS & ACCESS

4.1 General Requirements

MOD3 proposes a new local industrial cul-de-sac road, intersecting with Bakes Lane.

The overall estate layout and hierarchy will remain consistent with the approved layouts, and more importantly the under consideration SSD-9522 MOD2 layout.

The proposed road alignments will need to be designed to meet Council requirements. The proposed road layout will incorporate best practice for both horizontal and vertical alignments with empathy to the landform.

All roads will have concrete kerb and gutter and carriageway surface finished with asphaltic concrete as per the requirements of Penrith City Council.

The design for the proposed pavement for internal roads is to be based on *Austroads Pavement Design – A Guide to the Structural Design of Road Pavements.* Council DCP requires the pavement design to be based on a minimum traffic loading of $1x10^7$ ESA. This loading is typical of an industrial road and would meet the needs of the local estate roads. This would form part of the detail design phase of the development and final road construction.

The proposed road cross section is based on the arrangement proposed in the DCP, and proposed in the under consideration SSD-9522 MOD2 application layout. Refer drawings in **Appendix A** for details, and following sections for discussion intersection arrangements and agency consultation.

Table 4.1. Estate Road Cross Section

Road Type & Traffic Volume	Parking Lane Provision	Dedicated Travel Lanes	Verge Width (Footpath Pedestrian)	Total Road Reserve	Number of lanes	1.5m Footpath or 2.5m Shared Path
Industrial Road	8.0m (2 x 4.0m)	7.0m (2 x 3.5m)	4.0m 5.0m	24.0m	2 travel/ 2 parking lane	2.5m & 1.5m

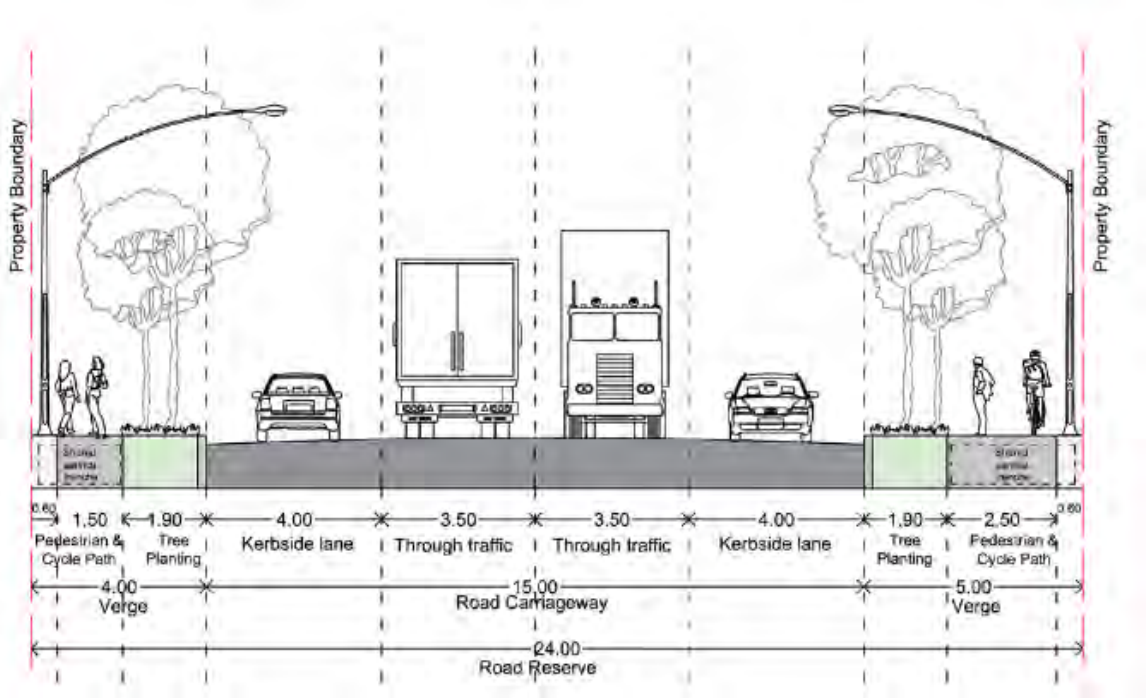

Figure 4.1. Industrial Road Cross Section- Draft Mamre Road DCP

4.2 Bakers Lane Intersection Arrangement

The concept design layout for the intersection with Bakers Lane is shown in drawings included in **Appendix A**, and **Figure 4.2** below.

The intersection is based on a priority arrangement, including for an auxiliary left and right turn entry. The intersection has been tested as part of the Ason Traffic Impact Assessment (TIA) (Ref: *1840r01 TA_Kemps Creek SSD 9522 MOD*) and deemed to meet required standards.

The geometry of the intersection allows for the swept paths of the 30m B-Double design vehicle (as required of SSD-9522 MOD2). Swept paths for the 26m B-Double have also been completed as required of the DRAFT Mamre Road Precinct DCP. Further, the intersection has been tested for the 36m B-Triple check vehicle as required of the DRAFT Mamre Road Precinct DCP. The paths and clearances show acceptable arrangements as per Austroads and TfNSW design guidelines.

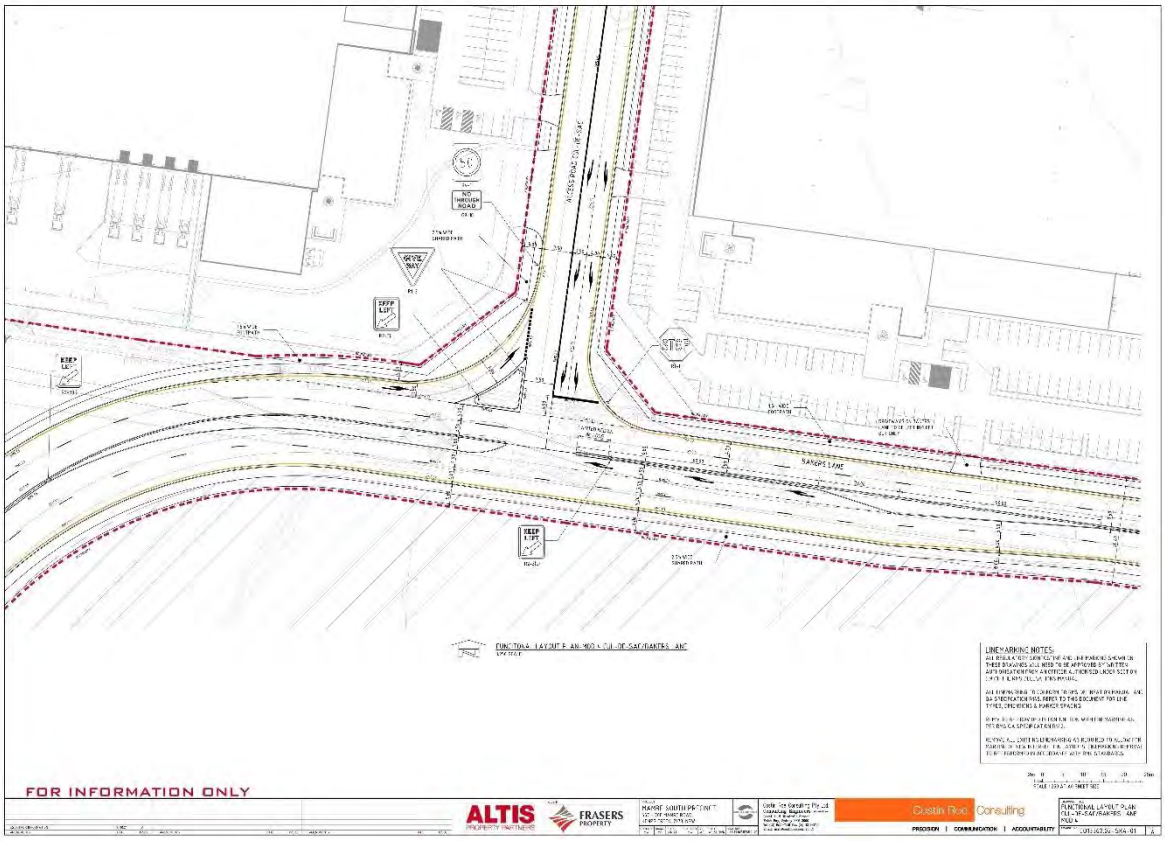

Figure 4.2. Bakers Lane and New Access Road Intersection Arrangement

4.3 Integration with Future Southern Link Road & TfNSW Consultation

A concept design layout for the intersection with Bakers Lane, the future Southern Link Road (SLR) and the new access road intersection is shown in drawings included in **Appendix A**, and **Figure 4.3** below. This arrangement is included in the application for information purposes only, as requested of TfNSW.

The geometry of the intersection allows for the swept paths of the 30m B-Double design vehicle (as required of SSD-9522 MOD2). Swept paths for the 26m B-Double have also been completed as required of the DRAFT Mamre Road Precinct DCP. Further, the intersection has been tested for the 36m B-Triple check vehicle as required of the DRAFT Mamre Road Precinct DCP. The paths and clearances show acceptable arrangements as per Austroads and TfNSW design guidelines.

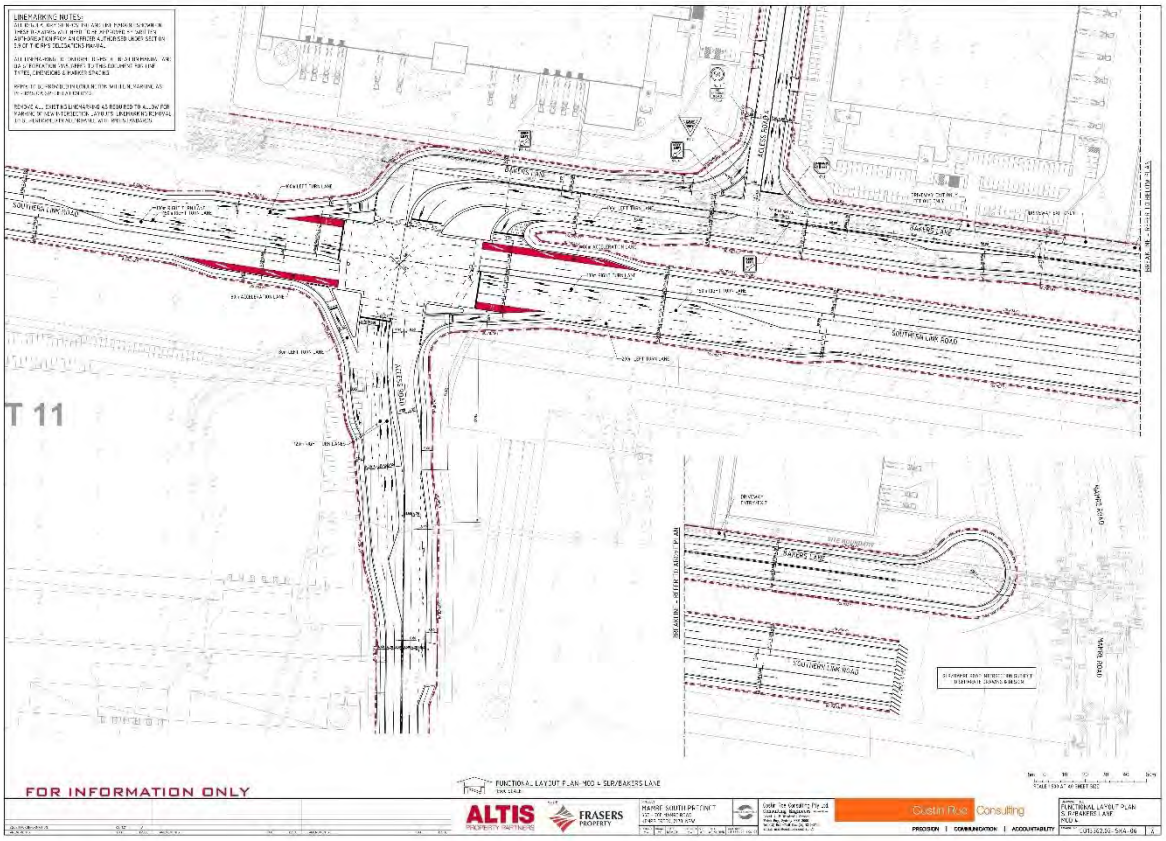

Figure 4.3. Bakers Lane, Future SLR and New Access Road Intersection Arrangement

As part of the pre- application consultation, TfNSW had provided comments for the proposal dated 3 November 2021. We provide responses to the design related items requested in the correspondence, noting these responses are to be read in conjunction with the traffic related items included in *Section 1.5* of the *ASON TIA*.

Table 4.2. Response to TfNSW Comments – Email Dated 3 November 2021

No.	Comment	CRC Response
SLR layout (CO13362.01-SK30-A): It is noted that the signalised intersection design has been provided to understand how the ultimate road layout will work with the proposed layout for the Lots 1-4 and will not be constructed under this SSDA. However the design still needs to be realistic in order to ensure that adequate land is reserved for the ultimate layout. In this regard, following comments are required to be addressed as part of this Modification to SSDA		
1a	TfNSW would require the signals to be designed as double diamond. This allows for better flexibility during time of heavy congestion.	The design allows for the ability for double-diamond arrangement to be introduced in phasing. The ASON TIA has tested single and double diamond and notes that due to the low volume of traffic from the north, compared to that from the south that the double-diamond arrangement has

No.	Comment	CRC Response
		lower efficiency than that as designed.
1b	Swept paths are required for further review. It is difficult to comment on the high angled entry without seeing the swept paths. Questions are raised as to whether a B-double could achieve the angles at the norther leg.	Refer to drawings **Co13362.00-SK4-06** to **SK4-09** included in A**ppendix A** for swept paths of design and check vehicles.
1c	North leg: ▪ The high angle of the north leg reduces visibility to the signals and is considered not acceptable ▪ The major movement will dominate the other movements which raises efficiency issues.	Measures can be introduced to address the visibility concerns to an acceptable level in detail design phase. These could include such measures as gantry traffic signals, early warning systems or other acceptable systems. Refer to ASON TIA which confirms acceptable efficiency for the intersection based on the proposed concept arrangement.
1d	Minimum distance required between turning vehicles is 2 metres – clarify distance	Clearances of greater than 2.0m to opposing vehicle paths has been achieved. Refer to drawings in **Appendix A**.
1e	It is unclear why a bus jump was not provided for the eastbound lane	A bus jump has been included. Refer to drawings in **Appendix A**.
1f	Why is there a chevron section on the south leg. This is not supported.	A chevron is proposed on the left turn out from Bakers Lane to the SLR only. This is provided to direct passenger vehicles in a smaller throat width, whilst allowing for larger vehicles to traverse their larger swept paths. Chevrons are in accordance with Austroads Design Guidelines.
1g	The west pedestrian leg extends over 7 lanes of traffic. There needs to be consideration of a staged crossing. Alternatively if there is low pedestrian movements, the median is to be wide enough to store a person and to include a push button. This should be provided on the west, and east leg of the intersection. This will require a larger footprint and should be identified now as the current arrangement will not be supported.	Pedestrian refuge has been included in the concepts to allow for staged crossings if required.
1h	North leg - The angle of the left turn slip lane creates vision impairments to the pedestrian signals and not accepted on safety ground.	Sufficient visibility is available in the concept layout. If additional measures are required to improve safety these could be introduced in detail design phase.

No.	Comment	CRC Response
1i	A modelling memo needs to be provided with the signal design to understand what steered the design.	Refer ASON TIA
TfNSW suggests that investigation be undertaken into the following design considerations:		
1h	extending the north leg straight north as opposed to following the current bakers lane alignment. This will remove most of the abovementioned concerns with regards to the obscure angle of north leg.	Consideration to extending the north leg has been made however this results in unacceptable commercial changes which do not suit the requirements or use of the land.
1k	Could the north leg left slip be relocated away from the signal as a separate uncontrolled intersection? If this is considered there will need to be adequate distance from the SLR/Mamre Road intersection so as to not have lane changing issues close to signals.	Relocation of the northern slip lane could be considered as part of future more detailed assessments. The concept shows that an intersection solution with the SRL is available, if the SLR is to be developed in the future.
Proposed interim design – IF2-KC-FS-550-B		
2a	The swept paths provide no indication of whether right turn movements are permitted (previous designs indicated they had right turn movements). Clarification is required, how will the right turn movements be restricted.	Refer to drawings **Co13362.00-SK4-06** to **SK4-09** included in A**ppendix A** for swept paths of design and check vehicles.
2b	Unclear of the distance from the signals to the access closest to Mamre Road – clarification required	Refer ASON TIA
2c	Access closest to Mamre Road – in order for a 26m B-double to undertake the turn they would need to undertake the turn from the wrong side. Any access should be able to accommodate for simultaneous entry/exit.	Refer ASON TIA
2d	3 driveways shown in close proximity (closest to Mamre Road) – light access, heavy access and light access - concern with conflicting movements, swept paths missing.	Refer ASON TIA
2e	The heavy vehicle access to lot 4 is very close to the access to Bakers lane and may cause queuing onto Bakers Lane (this could cause possible issue with the ultimate alignment and impact to the efficiency of	Refer ASON TIA

No.	Comment	CRC Response
	the signals also).	

6 WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY

6.1 Key Areas and Objectives

Water Cycle Management (WCM) is a holistic approach that addresses competing demands placed on a region's water resources, whilst optimising the social and economic benefits of development in addition to enhancing and protecting the environmental values of receiving waters.

The criteria and management measures included below are provided for information only, noting there are no proposed changes to the targets or assessments relating to water, which have been assessed and confirmed as acceptable per the approved SSD-9522 and SSD-9522 MOD1.

Several WCM measures have been included in the WCMS and engineering design, which are set out in this report and the attached drawings. The key WCM elements and targets which have been adopted in the design are included in **Table 6.1** following.

WCM and WSUD measures to meet objectives in **Table 6.1** are consistent with SEPP (WSEA) 2009 Clause 33L, and include consideration to water quality and quantity, natural flow regime, riparian and flooding considerations.

Table 6.1. WCM Targets Approved vis SSD-9522 and SSD-9522 MOD1

Element	Target	Reference
Water Quantity	Maintaining or improving the volume of stormwater flows to South Creek from this site. "*it will be necessary to demonstrate that there will be no increase in runoff from the site as a result of the development for all storms up to and including the 100-year Average Recurrence Interval (ARI) event for all storm durations*".	DPI Penrith Council - *Stormwater Management Policy, Section 3.3.3*
Water Quality	Load-based pollution reduction targets based on an untreated urbanised catchment: Gross Pollutants 90% Total Suspended Solids 85% Total Phosphorus 60% Total Nitrogen 45% Total Hydrocarbons 90%	Penrith Council DCP Part C3
Flooding	Buildings and road set 500mm above 1% AEP. No affectation to upstream downstream or adjoining properties as a result of development	Penrith Council DCP Part C3. NSW Floodplain Development Manual. Penrith Council DCP

		Part C3
Water Supply	Reduce Demand on non-potable water uses. Provide minimum 100,000kL rainwater tanks per development or 80% reduction of non-potable uses.	Penrith Council DCP Part C3.
Erosion and Sediment Control	Appropriate erosion and sedimentation control measures must be described in the environmental assessment for all stages of construction to mitigate potential impacts to South Creek.	Landcom Blue Book Penrith City Council DPI
Waterway and Stream Health	Confirmation of pre and post stream forming flows and Stream Erosion Index (SEI) no greater than 3.5.	Growth Centres DCP/ Penrith City Council WSUD Policy 2013

A summary of the how each of the WCM objectives will be achieved are described below. Reference to the relevant sections of the report should be made for further and technical details relating to the WCM measures:

- *Stormwater Quantity Management (Refer **Section 7**)*

  The intent of this criterion is to reduce the impact of urban development on existing drainage system by limiting post-development discharge within the receiving waters to the pre-development peak, and to ensure no affectation of upstream, downstream or adjacent properties.

  Attenuation of stormwater runoff from the development is proposed to be managed via one of the two estate level basins, which are currently under construction. The intention is for no water quantity measures to be provided on individual development lots. This will mean that future building developments can be assessed, approved and constructed without the need for site specific detention, based on the provision of the estate level detention basins. There are two proposed basins which are located at the downstream/ western end of the property. The two basins are noted to be proposed clear of the South Creek 1% AEP flood extent.

  Sizing of the detention systems has been completed using DRAINS modelling software in accordance with the Penrith City Council Policy for the 50% AEP to the 1% AEP storm for various durations. The modelling accounts for the drainage system provided for the adjacent sites and conveyance of upstream catchments around the site.

  Refer to **Section 7** of the document for detailed sizing of detention systems.

- *Stormwater Quality Management (Refer **Section 8**)*

  There is a need to target pollutants that are present in stormwater runoff to minimise the adverse impact these pollutants could have on downstream receiving waters.

  The required pollutant reductions are included in **Table 6.1** of this document and MUSIC modelling has been completed to confirm the reduction objectives can be met for the estate.

A series of Stormwater quality improvement devises (SQID's) have been incorporated in the design of the estate. The proposed management strategy will include the following measures:

- Primary treatment of the whole of the development catchment (including roads and development sites) will be made via one of two gross pollutant traps (GPT's). GPT's will be located upstream of each of the stormwater management basins.
- Tertiary treatment of the whole of the development catchment will be made via one of two estate level bio-retention basins. Bio-retention treatment will be provided within the stormwater management basins and are sized to treat the whole of the estate catchment.
- Some treatment will also be present by provision of rainwater reuse tanks on development sites through reuse and settlement within the tanks. Allowance for this treatment is noted to not be included in MUSIC modelling produced for the development.
- Development sites will not require any lot specific treatment systems due to the estate wide management systems proposed.

Reference to **Section 8** of this document should be made for detailed Stormwater Quality modelling and measures.

- *Flood Management (refer **Section 6.4**)*

  The proposed development considered flooding and large rainfall events, both from the adjacent South Creek, and from site generated runoff and upstream properties.

  Consideration to flood requirements has been made per the outcomes of the Overland Flow Assessment completed by our office as part of the original SSD-9522 EIS documentation. Refer **Section 6.4** and separate approved report **Co13362.00-19.rpt** for details.

  The following measures have been incorporated in the design:

  - All buildings are sited 500mm above the 1% AEP design flood level of South Creek.
  - Built form development is clear of the 1% AEP flood extent;
  - Requirements of Penrith City Council DCP Part C3 have been met regarding works in and around flooding areas;
  - Stormwater detention measures have been included to manage pre and post development runoff as discussed above and in **Section 8**; and
  - Overland flow paths to manage runoff in large storm events have been made including achieving at least 500mm freeboard to building levels from the flow paths.
- *Water Demand Reduction/ Rainwater Reuse*

  Rainwater reuse measures will be provided as part of future building development designs. Rainwater reuse will be required to provide a minimum 100,000 L tank and to reduce demand on non-potable uses by at 80%. The reduction in demand

will target non-potable uses such as toilet flushing and irrigation. **Refer Section 8.4**.

- *Waterway Health (Stream Erosion Index (SEI))*

  An SEI assessment for discharge from the development to South Creek has been completed based on industry accepted modelling technique for stream health.

  The SEI focuses on channel form with a critical flow threshold is estimated for the stream whereby excess flow is summed over time to produce a measure of the erosion potential in the stream. Results are compared to a baseline (PCC requires less than 3.5) scenario. In NSW, this metric (based on flow) has generally been called a stream erosion index (SEI) (DEC 2006). Confirmation that an SEI of 1.84 for the development, being below the PCC value of 3.5, has been included in **Section 7.5** of the report.

6.2 Existing Drainage System

6.2.1 Pre-Development & Yards Site Drainage

The undeveloped Yards site comprises rural land with undulating topography. There is no formal drainage currently on the site however several local depressions and natural gullies are present. There are also several dams which are used for the currently rural farming operations on the land which lie in relation to the natural gullies.

The Yards Estate is affected by overland flow from minor upstream catchments to the east of the site. A catchment of approximately 30 Ha is conveyed around the site via existing infrastructure in Mamre Road, diverting along the southern boundary of the site to South Creek. Two smaller catchments are also required to be conveyed through the site. Management of these upstream catchments is detailed in the approved SSD-9522 design documentation.

Two regional water quality and quantity management basins are being constructed as part of the Yards infrastructure works. *Estate Basin 1* is located in the South-Western corner of the Yards estate, and *Estate Basin 2* is located in the North-western corner of the development land. These basins attenuate stormwater from the newly constructed estate and discharges to the council trunk drainage system located to the north of the facility. The area subject to the MOD3 submission lies within the *Estate Basin 2* catchment area.

6.2.2 Proposed Site Drainage

The proposed stormwater system for the current proposal is to consist of a major/ minor system which conveys surface water from the proposed development lots to in-ground drainage connection points provided as part of the infrastructure construction works. Site water ultimately drains via the estate infrastructure to the combined water quality/ detention basin in the south-west corner of the site.

A summary of the main stormwater management measures is provided as follows:

- In-ground drainage system designed to accommodate the 1 in 20 year ARI storm event.
- Overland flow paths to convey the 1 in 100-year ARI storm event from the proposed development site to the Estate Basins (located on the west of the development site).
- Discharge of stormwater to estate infrastructure and estate stormwater management basin to the east of the development site; and
- Rainwater reuse in accordance with the estate development.

Further discussion on the *Stormwater Management Strategy* is provided in **Section 5** and **Section 6** of this report. It is noted that key water quantity and quality management measures are provided via estate management systems.

Reference to drawings in **Appendix A** shows the proposed drainage layout. All management measures remain consistent with approved SSD-9522 and SSD-9522 MOD1, noting drainage layouts have been adjusted to allow for the revised lot configuration and introduction of the new access road.

6.3 External Catchments and Flooding

Consideration to flooding is required due to the proximity to South Creek. Reference to the *Updated South Creek Flood Study (rp6033rg_crt150128-Updated South Creek Flood Study (FINAL – Volume 1))*, shows flood levels and flood extent associated with overland flow associated with the adjacent South Creek. This report will be referred to as the *South Creek Study* from hereon.

A comprehensive flood assessment is required for the development. This assessment has been completed by Costin Roe Consulting and presented in a separate report, refer **Co13362.00-19.rpt**, and included as part of the EIS and SSDA9522 submission documents.

As part of the assessment, the requirements of *Section 3.5 of PCC C3 Water Management DCP2014* (defines the requirements for flood liable land and relevant policy documents) have been considered. The requirements for development in flood liable land are based on the NSW Government *Floodplain Development Manual (2005)* document are also considered in the assessment.

The *South Creek Study* shows the property is adjacent to the zone of the 1% AEP event. The flood surface extent and level for the 1% AEP storm event, presented at the peak flow per the *South Creek Flood Study,* at the upstream boundary of the property can be seen to be 35.0m and 33.5m at the downstream boundary. Allowing for the council required freeboard of 500mm, the corresponding flood planning level for the development varies between RL 35.5m to 34.0m AHD.

The assessment by our office confirms the South Creek study levels and utilises a localised study and modelling area to confirm the effect of flooding on the development (ensuring planning levels are accounted), and also the effect of the development on

flooding. The intention being to meet Councils DCP Part C3 requirements and to ensure no offsite affectation to upstream, downstream or adjoining properties.

It is noted that the built form development footprint presented in this report is clear of and does not impact the 1% AEP event and that all development lots are above the PMF flood water levels.

It is further noted that there are no changes to the flood impacts or outcomes of the approved modelling associated with this MOD3 Application. Refer separate report within the SSD-9522 approval (**Co13362.00-19.rpt)** for comprehensive flood assessment and commentary.

6.4 Climate Change

Assessments relating to the effect of climate change on the development have been made in approved SSD-9522 and subsequent modification applications. The assessments, which have been approved, take into consideration potential effect from increased rainfall intensity and sea level rise. There are no changes to the previously accepted assessments resulting from the MOD3 application. Refer to previous assessments as required.

6.5 Water & Wastewater Servicing

A detailed *Service Infrastructure Assessment* has been completed by Landpartners Built Environment Consultants in conjunction with Frasers and Altis, and also in consultation with Sydney Water as part of the approved SSD_9522. There are no proposed amendments to the service strategy for the estate. Refer to approved documents in relation to water and wastewater servicing.

7 WATER QUANTITY MANAGEMENT

Penrith City Council adopts the principles of water quantity management, also known as "On-site Detention (OSD)", to ensure the cumulative effect of development does not have a detrimental effect on the existing stormwater infrastructure and watercourses located within their LGA downstream from the site.

As part of the approved Yards Estate Stormwater Management Strategy for the SSD9522 (including Mod 1 & Mod 2) development, On-site Detention (OSD) and drainage discharge measures have been designed and approved for the whole estate. OSD sizing is as per Section 3.3.3 of Councils stormwater management policy, which requires that "*it will be necessary to demonstrate that there will be no increase in runoff from the site as a result of the development for all storms up to and including the 100-year Average Recurrence Interval (ARI) event for all storm durations*".

The modelling has shown that, with the provision of a storage volume of 30,150 m^3 within *Estate Basin 1*, and 8,465 m^3 within *Estate Basin 2,* that stormwater flows from the development will be attenuated to pre-development flows. The area subject to change in the MOD3 application is noted to be managed within *Estate Basin 2*. A minor layout change is noted to the basin, however all previously assessed and approved storages and discharge relations remain consistent.

Detention storage is noted to be fully active. The main detention storage areas are noted to be sited at a level approximately 1m below the bio-retention elements. This will ensure effective discharge of bio-retention filtration, however also assists in ensuring maximum storage capacity can be realised. Further this enables depth of water over the bio-retention elements to be limited.

Attenuation of the overland flow from the northern and western catchments described in the earlier sections of this report have been made to maximise attenuation during storm events, and to ensure that the effect of the removal of pre-existing dams are mitigated.

As all stormwater quantity measures are provided as part of the Estate Management Measures and the approved systems are consistent with the current MOD3 submission. As such no additional stormwater quantity management measures are necessary for individual development lots, or the MOD3 layout, and as such none are proposed or required for this development site.

8 STORMWATER QUALITY, HARVESTING & MAINTENANCE

8.1 Stormwater Quality

There is a need to provide design which incorporates the principles of Water Sensitive Urban Design (WSUD) and to target pollutants that are present in the stormwater to minimise the adverse impact these pollutants could have on receiving waters and to also meet the requirements specified by Penrith City Council.

PCC have nominated, in Section C3 of their *DCP 2014*, the requirements for stormwater quality to be performed on a catchment wide basis. These are presented in terms of annual percentage pollutant reductions on a developed catchment and are as follows:

Gross Pollutants	90%
Total Suspended Solids	85%
Total Phosphorus	60%
Total Nitrogen	45%
Total Hydrocarbons	90%
Free Oil and Grease	90%

Developed impervious areas of the estate, including roof, hardstand, car parking, roads and other extensive impervious areas are required to be treated by the Stormwater Treatment Measures (STM's). The STM's shall be sized according to the whole catchment area of the development. The STM's for the estate are based on a treatment train approach at the estate level to ensure that all the objectives above are met.

Components of the estate treatment train for the estate are as follows:

- Primary treatment of site runoff will be made via one of two Estate GPT's. The Estate GPT's are located at the downstream of the Estate drainage network and immediately upstream of the stormwater management basins.
- Tertiary treatment of site runoff will be made via The Estate bio-retention system which is integrated within the estate stormwater management basins. Management of water quality during construction will also be provided through sediment control measures; and
- A portion of the future building roofs will also provide a level of treatment via rainwater reuse and settlement within the building rainwater tanks.

There are no changes required or proposed to the approved estate stormwater management system, or discharge arrangements from the overall project, as a result of the MOD3 Masterplan development. The overall estate development area of 89 Ha, and associated development coverage for the remains consistent with that approved under SSD 9522, SSD9522 MOD1 and the under consideration MOD2. We reiterate there will be no change to the assessed management systems and/or discharge arrangements approved under SSD9522 and SSD9522 Mod1.

The SSD 9522 approved stormwater management system incorporates water quantity and quality management systems consistent with accepted practices for the fully developed estate catchment. The approved estate system has been assessed as achieving acceptable stormwater discharge flow rates and water quality outcomes.

EES proposes alternate water quantity and quality measures to those currently approved. Given there are no changes to the estate development areas and impervious surface coverage for the MOD3 Masterplan layout, or proposed to the assessed and approved management systems further assessments of the stormwater management systems are not considered warranted.

As The Estate stormwater management systems, as approved for SSD-9522 and SSD-9522 Mod1, meet all of the required stormwater management objectives, additional on-lot treatment is thereby not required nor proposed as part of the MOD3 development.

8.2 Stormwater Harvesting

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system for re-use in non-potable applications. Stormwater from the stormwater drainage system can be classified as either rainwater, where the flow is from roof areas only, or stormwater where the flow is from all areas of the development.

Rainwater harvesting will be provided for this development with re-use for non-potable applications as part of future individual building development applications. Internal uses include such applications as toilet flushing while external applications will be used for irrigation. The aim is to reduce the water demand for the development and to satisfy the requirements of PCC DCP2014.

In general terms the rainwater harvesting system will be an in-line tank for the collection and storage of rainwater. At times when the rainwater storage tank is full rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system. Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system.

Rainwater tanks are to be sized with reference to the NSW Department of Environment and Conservation document *Managing Urban Stormwater: Harvesting and Reuse*, using a simple water balance analysis to balance the supply and demand, based on the base water demands and a minimum demand reduction of 80%.

The final sizing of rainwater harvesting tanks will need to be assessed once the development layout and reuse demands for the facility are known in accordance with the NSW Department of environment and Conservation document Managing Urban Stormwater: Harvesting and Reuse.

8.3 Maintenance and Monitoring

It is important that each component of the water quality treatment train is properly operated and maintained. To achieve the design treatment objectives, an indicative maintenance schedule has been prepared (refer to **Appendix B**) to assist in the effective operation and maintenance of the various water quality components.

Note that inspection frequency may vary depending on site specific attributes and rainfall patterns in the area. In addition to the below nominated frequency it is recommended that inspections are made following large storm events.

9 EROSION & SEDIMENT CONTROL PLAN

9.1 Soil and Water Management General

Section 1 provides a summary of the construction works for the Proposal. While all construction activities have the potential to impact on water quality, the key activities are:

- Erosion and sediment control installation.
- Grading of existing earthworks to suit building layout, drainage layout and pavements.
- Stormwater and drainage works.
- Service installation works.
- Building construction works.

Without any mitigation measures and during typical construction activities, site runoff would be expected to convey a significant sediment load. A *Soil and Water Management Plan* (SWMP) and *Erosion and Sediment Control Plan* (ESCP), or equivalent, would be implemented for the construction of the Proposal. The SWMP and ESCPs would be developed in accordance with the principles and requirements of *Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book')(Landcom, 2004)*.

In accordance with the principles included in the Blue Book, a number of controls have been incorporated into a preliminary ESCP (refer to accompanying Drawings in **Appendix A**) and draft SWMP in **Appendix C**.

The sections below outline the proposed controls for management of erosion and sedimentation during construction of the Proposal, noting many of the measures are currently being implemented on site as part of ongoing construction activities currently being completed per SSD-9522 and SSD-9522 MOD1 approvals.

9.2 Typical Management Measures

Sediment Basins

Sediment basins have been sized (based on 5 day 85th percentile rainfall) and located to ensure sediment concentrations in site runoff are within acceptable limits. Preliminary basin sizes have been calculated in accordance with the Blue Book and are based on 'Type F' soils. These soils are fine grained and require a relatively long residence time to allow settling.

Sediment basins for 'Type F' soils are typically wet basins which are pumped out following a rainfall event when suspended solids concentrations of less than 50 mg/L have been achieved.

Sediment Fences

Sediment fences are located around the perimeter of the site to ensure no untreated runoff leaves the site. They have also been located around the existing drainage channels to minimise sediment migration into waterways and sediment basins.

Stabilised Site Access

For the proposal, stabilised site access is proposed at one location at the entry to the works area. This will limit the risk of sediment being transported onto public roads.

9.3 Other Management Measures

Other management measures that will be employed are expected to include:

- Minimising the extent of disturbed areas across the site at any one time.
- Progressive stabilisation of disturbed areas or previously completed earthworks to suit the proposal once trimming works are complete.
- Regular monitoring and implementation of remedial works to maintain the efficiency of all controls.

It is noted that the controls included in the preliminary ESCP are expected to be reviewed and updated as the design, staging and construction methodology is further developed for the Proposal.

10 CONCLUSION

This Civil Engineering Report has been prepared as part of a Modification Application (MOD3) to the approved SSD-9522. The modification relates to a revised masterplan for Lots 1-4 and introduction of a new local industrial road, north of Bakers Lane. The approved development is noted to be for 89 Ha of industrial development with a 118 Ha land parcel surrounding the proposed Southern Link Road, existing Bakers Lane and Mamre Road, Erskine Park. This submission proposes modification to the masterplan layout for parts of the development north of Bakers Lane only.

An overview of requirements for stormwater and access has been provided to assist in the SSDA MOD3 submission. Specific mention has been made to on-site detention and water quality requirements as required as part of the *Water Cycle Management Plan* for the estate.

A strategy for the management of stormwater quality and quantity has been provided based on the management measures to be provided in end-of-line estate level management basins, as assessed and approved in SSD-9522 and SSD-9522 MOD1. The two combined detention and water quality systems located on the western flank of the development extent which are currently under construction will manage post-development runoff per the approved stormwater management objectives. This remains consistent with he approved SSD-9522 strategy, noting the modified layout north of Bakers Lane is managed by *Estate Basin 2*.

The built form development is located in the vicinity of, however clear of the predicted 1% AEP South Creek flood extent. The floor levels of proposed buildings near South Creek will be set as a minimum to the 1% AEP flood level plus 0.5m freeboard in accordance with the requirements of Penrith City Council and the NSW Floodplain Development Manual. Reference to separate approved flood report and assessment by Costin Roe Consulting should be made in relation to flooding (refer separate approved report **Co13362.00-19a.rpt**).

We confirm that the proposed stormwater management strategy, flood modelling assessment and all outcomes remain consistent with the approved SSD-9522 development, the SSD-9522 MOD1, the under consideration MOD2 application and the proposed MOD3 application.

11 REFERENCES

Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC);

Managing Urban Stormwater: Source Control – 1998 (NSW EPA);

Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);

Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM);

Penrith City Council – *WSUD Technical Guidelines*

Penrith City Council – *Water Sensitive Urban Design (WSUD) Policy*

Penrith City Council – DCP 2010 (Part C3); and

Water Sensitive Urban Design – "Technical Guidelines for Western Sydney" by URS Australia Pty Ltd, May 2004

Appendix B
DRAFT STORMWATER MAINTENANCE SCHEDULE

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Six monthly	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Six Monthly	Maintenance Contractor	Replace topsoil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
ESTATE BIO-RETENTION BASIN			
Check all items nominated for SWALES/ LANDSCAPED AREAS above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above
Check for sediment accumulation at inflow points	Six monthly/ After Major Storm	Maintenance Contractor	Remove sediment and dispose in accordance with local authorities' requirements.
Check for erosion at inlet or other key	Six monthly/ After Major	Maintenance	Reinstate eroded areas so that original, designed

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
structures.	Storm	Contractor	profile is maintained
Check for evidence of dumping (litter, building waste or other).	Six monthly	Maintenance Contractor	Remove waste and litter and dispose in accordance with local authorities' requirements.
Check condition of vegetation is satisfactory (density, weeds, watering, replating, mowing/ slashing etc)	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Check for evidence of prolonged ponding, surface clogging or clogging of drainage structures	Six monthly/ After Major Storm 10-15 years	Maintenance Contractor	Remove sediment and dispose in accordance with local authorities' requirements. Replace filter media & planting – refer to appropriately qualified engineer or stormwater specialist
Check stormwater pipes and pits	Six monthly/ After Major Storm	Maintenance Contractor	Refer to INLET/ JUNCTION PIT section below.
ESTATE OSD BASIN			
Check all items nominated for SWALES/ LANDSCAPED AREAS above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely and remove any blockages or debris.
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/ sludge build up and check orifice and flap valve is clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.
RAINWATER TANK			
Check for any clogging and blockage	Monthly	Maintenance Contractor	First flush device to be cleaned out

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
of the first flush device			
Check for any clogging and blockage of the tank inlet - leaf/litter screen	Six monthly	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable depth as specified by the hydraulic consultant
INLET & JUNCTION PITS			
Inside of pits	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.
Outside of pits	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.

Appendix C

DRAFT EROSION AND SEDIMENT CONTROL PLAN & CHECKLIST

C.1 Introduction

An erosion and sediment control plan (ESCP) is shown on drawing **Co13362.00-C4-200** with details on **C4-250**. These are conceptual plans only providing sufficient detail to clearly show that the works can proceed without undue pollution to receiving waters. A detailed plan will be prepared once consent is given and before works start.

C.2 General Conditions

1. The ESCP will be read in conjunction with the engineering plans, and any other plans or written instructions that may be issued in relation to development at the subject site.
2. Contractors will ensure that all soil and water management works are undertaken as instructed in this specification and constructed following the guidelines stated in *Managing Urban Stormwater, Soils and Construction (1998) "The Blue Book"* and Penrith City Council specifications.
3. All subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to down slope areas.

C.3 Land Disturbance

1. Where practicable, the soil erosion hazard on the site will be kept as low as possible and as recommended in Table C.1.

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans.	All site workers will clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones onsite. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.
Remaining lands	Entry prohibited except for essential management works	

Table C.1 Limitations to access

C.4 Erosion Control Conditions

1. Clearly visible barrier fencing shall be installed as shown on the plan and elsewhere at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only those essential for construction work and they shall enter the site only through the stabilised access points.
2. Soil materials will be replaced in the same order they are removed from the ground. It is particularly important that all subsoils are buried and topsoils remain on the surface at the completion of works.
3. Where practicable, schedule the construction program so that the time from starting land disturbance to stabilisation has a duration of less than six months.
4. Notwithstanding this, schedule works so that the duration from the conclusion of land shaping to completion of final stabilisation is less than 20 working days.
5. Land recently established with grass species will be watered regularly until an effective cover has properly established and plants are growing vigorously. Further application of seed might be necessary later in areas of inadequate vegetation establishment.
6. Where practical, foot and vehicular traffic will be kept away from all recently established areas
7. Earth batters shall be constructed in accordance with the Geotechnical Engineers Report or with as law a gradient as practical but not steeper than:
   - 2H:1V where slope length is less than 7 metres
   - 2.5H:1V where slope length is between 7 and 10 metres
   - 3H:1V where slope length is between 10 and 12 metres
   - 4H:1V where slope length is between 12 and 18 metres
   - 5H:1V where slope length is between 18 and 27 metres
   - 6H:1V where slope length is greater than 27 metres
8. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event.
9. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.

C.5 Pollution Control Conditions

1. Stockpiles will not be located within 5 metres of hazard areas, including likely areas of high velocity flows such as waterways, paved areas and driveways. Silt/ sediment fences and appropriate stabilisation of stockpiles are to be provided as detailed on the drawings.
2. Sediment fences will:
   a) Be installed where shown on the drawings, and elsewhere at the discretion of the site superintendent to contain the coarser sediment fraction (including aggregated fines) as near as possible to their source.
   b) Have a catchment area not exceeding 720 square meters, a storage depth (including both settling and settled zones) of at least 0.6 meters, and internal dimensions that provide maximum surface area for settling, and
   c) Provide a return of 1 metre upslope at intervals along the fence where catchment area exceeds 720 square meters, to limit discharge reaching each section to 10 litres/second in a maximum 20-year t_c discharge.
3. Sediment removed from any trapping device will be disposed in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.
4. Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped and/or likely sediment has been treated in an approved device). Nevertheless, stormwater inlets will be protected.
5. Temporary soil and water management structures will be removed only after the lands they are protecting are stabilised.

C.6 Waste Management Conditions

Acceptable bind will be provided for any concrete and mortar slurries, paints, acid washings, lightweight waste materials and litter. Clearance service will be provided at least weekly.

C.7 Site Inspection and Maintenance

1. A self-auditing program will be established based on a Check Sheet. A site inspection using the Check Sheet will be made by the site manager:
   - At least weekly.
   - Immediately before site closure.
   - Immediately following rainfall events in excess of 5mm in any 24-hour period.

The self-audit will include:

- Recording the condition of every sediment control device
- Recording maintenance requirements (if any) for each sediment control device
- Recording the volumes of sediment removed from sediment retention systems, where applicable
- Recording the site where sediment is disposed
- Forwarding a signed duplicate of the completed Check Sheet to the project manager/developer for their information

2. In addition, a suitably qualified person will be required to oversee the installation and maintenance of all soil and water management works on the site. The person shall be required to provide a short monthly written report. The responsible person will ensure that:
   - The plan is being implemented correctly
   - Repairs are undertaken as required
   - Essential modifications are made to the plan if and when necessary

The report shall carry a certificate that works have been carried out in accordance with the plan.

3. Waste bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Site Superintendent.
4. Proper drainage will be maintained. To this end drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that,
   - No low points exist that can overtop in a large storm event
   - Areas of erosion are repaired (e.g. lined with a suitable material) and/or velocity of flow is reduced appropriately through construction of small check dams of installing additional diversion upslope.
   - Blockages are cleared (these might occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, breached by vehicle wheels, etc.).
5. Sand/soil/spoil materials placed closer than 2 meters from hazard areas will be removed. Such hazard areas include and areas of high velocity water flows (e.g. waterways and gutters), paved areas and driveways.
6. Recently stabilised lands will be checked to ensure that erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.
7. Excessive vegetation growth will be controlled through mowing or slashing.
8. All sediment detention systems will be kept in good, working condition. In particular, attention will be given to:
   a) Recent works to ensure they have not resulted in diversion of sediment laden water away from them

b) Degradable products to ensure they are replaced as required, and

c) Sediment removal, to ensure the design capacity or less remains in the settling zone.

9. Any pollutants removed from sediment basins or litter traps will be disposed of in areas where further pollution to down slope lands and waterways should not occur.
10. Additional erosion and/or sediment control works will be constructed as necessary to ensure the desired protection is given to down slope lands and waterways, i.e. make ongoing changes to the plan where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.
11. Erosion and sediment control measures will be maintained in a functioning condition until all earthwork activities are completed and the site stabilised
12. Litter, debris and sediment will be removed from the gross pollutant traps and trash racks as required.